

I (we) claim:

1. An engine control apparatus configured to be in cooperation with an engine, the engine including an addition device for adding a NOx reducing agent to exhaust gas of the engine, the engine control apparatus comprising:

a control unit for controlling the engine, wherein  
the control unit detects an abnormality having occurred in the addition device, to restrict an output of the engine at a time of the abnormality occurrence when the occurrence of the abnormality is detected.
2. An engine control apparatus according to claim 1, wherein, at the time of the abnormality occurrence, the control unit varies an output characteristic of the engine relative to an accelerator operation by a driver from that at a normal time other than the time of the abnormality occurrence.
3. An engine control apparatus according to claim 2, wherein the control unit changes a fuel supply quantity to the engine at the time of the abnormality occurrence from that at the normal time, under the same accelerator operating amount, to vary the output characteristic of the engine.
4. An engine control apparatus according to claim 3, wherein, on the basis of the same accelerator operating amount, the control unit decreases the fuel supply quantity at the time of the abnormality occurrence than that at the normal time.
5. An engine control apparatus according to claim 3,

wherein the engine is mounted on a vehicle, and  
wherein the control unit, at the time of the abnormality occurrence, calculates a first fuel supply quantity for controlling a vehicle speed at a predetermined value, and also calculates a second fuel supply quantity according to an accelerator operating amount, and sets the smaller one of the first and second fuel supply quantities as a final fuel supply quantity.

6. An engine control apparatus according to claim 3, wherein the engine is mounted on a vehicle, and wherein the control unit stores a first fuel supply quantity previously set as one for maintaining a vehicle speed at a predetermined value, and at the time of abnormality occurrence, calculates a second fuel supply quantity according to an accelerator operating amount, and sets the smaller one of the first and second fuel supply quantities as a final fuel supply quantity.
7. An engine control apparatus according to claim 3, wherein the engine is mounted on a vehicle, and wherein the control unit detects a vehicle speed, and varies the fuel supply quantity only when the detected vehicle speed is larger than a predetermined value.
8. An engine control apparatus according to claim 1, wherein the control unit inhibits restarting of the engine operation after the engine operation stops, to restrict the output of the engine.
9. An engine control apparatus according to claim 8, wherein the control unit breaks the connection between a starter for cranking the engine, and a power supply unit for the starter, to thereby inhibit the restarting of the engine operation.
10. An engine control apparatus according to claim 8, wherein the control unit inhibits the fuel supply to the engine, to thereby inhibit the restarting of the engine operation.
11. An engine control apparatus according to claim 1, wherein the control unit stops the engine operation after a predetermined period of time has elapsed from detection of the abnormality occurrence.
12. An engine control apparatus according to claim 1, wherein the engine comprises a tank for storing an aqueous solution of the NO<sub>x</sub> reducing agent or an precursor thereof, which is added

to the exhaust gas by the addition device, and  
wherein the control unit comprises a first sensor for detecting a concentration of the NO<sub>x</sub> reducing agent or the precursor contained in the aqueous solution stored in the tank, and when a value of the concentration detected by the first sensor is out of a predetermined range, detects the abnormality occurred in the addition device.

13. An engine control apparatus according to claim 12, wherein the first sensor comprises a sensor element part disposed in the tank, and a circuit part connected to the sensor element part, and wherein  
the sensor element part includes a heater, and a temperature sensing element disposed to be in directly or indirectly contact with the aqueous solution in the tank and to be heated by the heater, the temperature sensing element having a property in which an electrical characteristic value thereof changes according to a temperature thereof, and  
the circuit part activates the heater and also detects the electrical characteristic value of the heated temperature sensing element, and detects the concentration of the NO<sub>x</sub> reducing agent or the precursor based on the detected electrical characteristic value.

14. An engine control apparatus according to claim 1,  
wherein the engine comprises a tank for storing an aqueous solution of the NO<sub>x</sub> reducing agent or a precursor thereof, which is added to the exhaust gas by the addition device, and  
wherein the control unit comprises a second sensor for detecting a residual quantity of the aqueous solution stored in the tank, and when a value of the residual quantity detected by the second sensor is smaller than a predetermined value, detects the abnormality occurred in the addition device.

15. An engine control apparatus according to claim 1, wherein the NO<sub>x</sub> reducing agent is ammonia.

16. An engine control apparatus according to claim 15, wherein the addition device adds urea as a precursor of ammonia to the exhaust gas,

to thereby add the NOx reducing agent.

17. An engine control apparatus according to claim 1, wherein at the time of the abnormality occurrence, the control unit operates a warning device for notifying a driver of the abnormality occurrence.

18. An engine control apparatus according to claim 1, comprising a first control unit for controlling the engine, and a second control unit for controlling the addition device, wherein

the second control unit controls the addition device at both of the time of the abnormality occurrence, and a normal time other than the time of the abnormality occurrence, and

the second control unit, at the normal time, operates the addition device to add the NOx reducing agent by an amount according to engine operating conditions, while at the time of the abnormality occurrence, stops the adding of the NOx reducing agent by the addition device.

19. An engine control apparatus configured to be in cooperation with an engine, the engine including an addition device for adding a NOx reducing agent to exhaust gas of the engine, the engine control apparatus comprising:

detection means for detecting an abnormality having occurred in the addition device; and

control means for restricting an output of the engine at a time of an abnormality occurrence when the abnormality occurrence is detected by the detection means.

20. A method for operating an engine at both a time of an abnormality occurrence when an abnormality occurs in an addition device, and a normal time other than the time of the abnormality occurrence, the addition device being disposed in the engine to add a NOx reducing agent to exhaust gas of the engine, the method comprising the steps of:

operating, at the normal time, the engine with a first characteristic in which an output of the engine corresponding to an accelerator operating amount by a driver is obtained, wherein an operating condition of the engine is detected, and the NOx reducing agent by an amount

corresponding to the detected operating condition is added by the addition device, and

inhibiting, at the time of the abnormality occurrence, the engine operation, or operating the engine with a second characteristic in which the output relative to the accelerator operating amount is decreased than that obtained when operating the engine with the first characteristic.